Five-Year Review Report

(2nd Five-Year Review Report)
For
Algoma Municipal Landfill
Algoma
Kewaunee County, Wisconsin

03/29/2004

Prepared by:

Wisconsin Department of Natural Resources
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For
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Approved by:

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Date:

4-27-04

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Executive Summary

The remedy for the Algoma Municipal Landfill consists of a two-foot compacted clay cover on the Landfill Disposal Area (LDA) and the North Disposal Area (NDA) with an overlying soil layer to prevent freeze-thaw degradation of the clay. The remedy for the South Disposal Area (SDA) consists of a soil cover. A landfill gas venting system with monitoring probes is present on the LDA and NDA. A groundwater sampling program to measure changes in groundwater conditions near and away from the site is in its 19th year of monitoring. Institutional controls include access restrictions, deed restrictions and site fencing.

The assessment of this Five-Year Review found that the remedy is functioning as designed. The immediate threats have been addressed and the remedy is protective at this time. When groundwater cleanup standards are met, the long-term protectiveness of the remedy will be met.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site name Algoma Municipal Landfill		
EPA ID:WID980610380		
Region: 5	State: WI	City/County: Algoma/Kewaunee
SITE STATUS		
NPL Status: Final		
Remediation Status: Complete		
Multiple OUs: NO	Construction Completion Date: March 1994	
Has site been put to reuse: No		
REVIEW STATUS		
Lead Agency: EPA		
Author Name: Annette Weissbach		
Author Title: Hydrogeologist	Author Affiliation: WI Dept of Natural Resources	
Review Period: January through March 2004		
Date of Site Inspection: March 24, 2004		
Type of Review: Post SARA		
Review Number: 2nd		
Triggering Action: Previous Five-Year Report		
Triggering Action Date: March 29, 1999		
Due Date: March 29, 2004		

Five Year Review Summary Form, Cont'd.

Issues:

1) Methane was detected in Gas Monitoring Probe GMP-7 in 2002 but not in 2003. The 2002 reading was the first ever at this location. The concentrations of methane were below the lower explosive limits and may have been an anomaly associated with open pit gravel operations immediately adjacent to the landfill and gas probes.
2) The sand and gravel operations adjacent to the landfill have likely reached their maximum encroachment near the LDA landfill area.

Recommendations and Follow-up Actions:

1) Continued monitoring of all gas monitoring probes and vents and annual inspections and monitoring of site groundwater wells.
2) The PRP group and the owners of the adjoining gravel pit should discuss the requirement to maintain appropriate slope and distance from the landfill and the monitoring points. It is recommended that a written agreement be signed by both parties that describes these requirements.

Protectiveness Statement:

The remedy continues to be protective of human health and the environment in the short-term. Threats at the site have been addressed through capping of the waste material, passive venting of landfill gases, and site fencing.

Long-term Protectiveness:

Long-term protectiveness of the remedial action will be verified by continuing routine groundwater sampling to monitor migration of the contaminant plume downgradient of the landfill. Exceedances of iron and manganese public welfare standards for groundwater are anticipated to continue for 10 to 20 years. Additional sampling and analysis will continue annually until ARARs are met. Site will achieve long-term protectiveness when groundwater clean-up standards are met.

List of Acronyms

AMLF	Algoma Municipal Landfill
ARAR	Applicable or Relevant and Appropriate Requirement
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
EA	Endangerment Assessment
ES	Enforcement Standard (e.g. NR 140 WAC)
LDA	Landfill Disposal Area
NCP	National Contingency Plan
NDA	North Disposal Area
NPL	National Priorities List
NR	Natural Resources (e.g. WAC)
PAL	Preventive Action Limit (e.g. NR 140 WAC)
PM	Project Manager
PRP	Potentially Responsible Party(ies)
RI/FS	Remedial Investigation/Feasibility Study
RD/RA	Remedial Design/Remedial Action
RPM	Remedial Project manager
SARA	Superfund Amendments and Reauthorization Act
SDA	South Disposal Area
US EPA	United States Environmental Protection Agency
WAC	Wisconsin Administrative Code
WDNR	Wisconsin Department of Natural Resources

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(scanned from the ***Five-Year Groundwater Assessment Report and Operation & Maintenance Report No. 15)***

Figure 1 Site Map
Figure 5 Conceptual site model
Figure 9 Iron and Manganese concentrations in nearby private drinking water wells

I. Introduction

Purpose of the Review

The purpose of the five-year review is to determine whether the remedy at the site is protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in five-year review reports. Five-year review reports identify issues found during the review, if any, and recommendations to address them.

Authority for Conducting the Review

The Wisconsin Department of Natural Resources (WDNR) is preparing this five-year review pursuant to CERCLA §121 and the National Contingency Plan (NCP). CERCLA §121 states:

> *If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review remedial actions no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such a review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

The WDNR and the United States Environmental Protection Agency (US EPA) interpreted this requirement further in the NCP; 40 CFR §300.430(f)(4)(ii) states:

> *If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited sue and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.*

The WDNR has conducted a five-year review of the remedial action implemented at the Algoma Municipal Landfill in the Town of Ahnapee, Kewaunee County, Wisconsin. The review was conducted from January 2004 through March 2004. This report documents the results of the review.

RMT, Inc., an Environmental Consultant based in Madison, WI, prepared a ***Five-year Groundwater Assessment Report*** and ***Operation & Maintenance Report No. 15*** on behalf of the Algoma Settling Defendants (the Potentially Responsible Party [PRP] group). The combined report was received by WDNR on December 17, 2003. Information from these combined reports assisted in the evaluation and preparation of this five-year review Report.

This five-year review is the second five-year review for the Algoma Municipal Landfill. The triggering action for this review is the date of the final first five-year review. The

first five-year review was prepared by EPA-Region V and is dated March 29, 1999. The post-SARA (Superfund Amendments and Reauthorization Act of 1986) remedial action taken at the Algoma Municipal Landfill has left hazardous substances, pollutants, or contaminants on site above levels that allow for unlimited use and unrestricted exposure. Therefore a subsequent five-year review is required by statute.

This second five-year review is being completed for the entire site.

II. Site Chronology

Table 1 Site Chronology

Date	*Event*
1984	Groundwater study discovers hazardous substances
May 1986	Proposed for inclusion on the NPL
July 1987	Site placed on NPL
February 1987	Notice Letters initiating negotiations mailed to seven identified PRPs
January 1988	Consent order signed
June 1988	Site Investigation started by PRP under consent order
June 1990	Completion of Remedial Investigation and Endangerment Assessment
September 1990	Record of Decision signed
August 1991	Consent Decree signed by US EPA, WDNR, and PRP group
October 1992	Explanation of Significant Differences signed
November 1992	Submittal of Final RD/RA workplan
April 1993	Remedial Design approved
July 1993	Remedial Action started
December 1993	Remedial Action completed
March 1994	Preliminary Site Close Out Report signed
March 1999	First five-year review completed

III. Background

Physical Characteristics

The Algoma Municipal Landfill (AMLF) was leased to the City of Algoma by Dumman Realty and occupies a total of approximately 13 acres of disposal area. Seven acres of this property were licensed and operated by the City of Algoma as a municipal landfill between 1969 and 1983. Approximately 400,000 cubic yards of municipal and other wastes are contained within the boundary. The landfill expanded over an additional three acres during its operation and the buried waste quantity is included in the estimated waste volume. Areas filled outside of the licensed tract are considered part of the AMLF. In all there are four recognized disposal areas (see Figure 1):

- LDA: Landfill Disposal Area, approximately 12.3 acres in size. The LDA accepted approximately 400,000 cubic yards of industrial, commercial and residential wastes.

- ADA: animal disposal area, used to dispose of animal carcasses. The ADA is a depression on the eastern edge of the LDA and is included in the LDA.
- NDA: North Disposal Area, approximately 1.1 acres in size. The NDA accepted approximately 16, 000 cubic yards of construction debris.
- SDA: South Disposal Area, approximately 3.5 acres in size. The SDA accepted approximately 36, 000 cubic yards of white goods and construction debris.

During its operation, the AMLF accepted wastes from residential, commercial and industrial sources which included paints and solvents. It is alleged that upon disposal, wastes were covered with sludges containing asbestos.

The soils at the site are part of the Casco-Boyer series and are described as well drained, medium to coarse in texture and underlain by course-textured sediment. The Pleistocene deposits below the soil are representative of typical Wisconsin glaciation sequences with mixtures of sand and gravel interbedded with clay lenses. In the surrounding area, these deposits extend to approximately 100-130 feet in depth and are known as the Kewaunee Formation deposited by the Green Bay and Lake Michigan Lobes. The underlying bedrock is encountered between 98 and 136 feet and consists of the light gray, massive to thinly bedded dolomite of the Silurian Niagara Formation. Nearby residents and commercial operations draw water mostly from the upper reaches of this dolomite formation, although occasional older water supply wells utilize the sand and gravel aquifer.

The topography surrounding the site is gently rolling to flat with pockets of ravines and wetlands. The AMLF is located 3,500 feet south-southwest of Silver Creek, 3,000 feet north-northeast of Three Mile Creek, and about 1½ miles from the city limits of Algoma. Lake Michigan is located 2½ miles east of the landfill. The surrounding land use in the immediate vicinity is agricultural and commercial gravel pits.

Land and Resource Use

The land surrounding the AMLF to the south and west is zoned commercial (gravel pits) and to the north and east, A-1 agriculture. To the southeast it is zoned upland conservancy. According to the Town of Ahnapee Comprehensive Plan continued Rural Residential Development and gravel pit operations could be expected surrounding the landfill. However, development tends to be limited by a WDNR 1,200-foot setback for residential well construction near landfills.

Local rural residential water consumption tends to draw from the bedrock formation as opposed to the sand and gravel aquifer. Local well drillers report that a high silt content limits the use of the sand and gravel aquifer for use as drinking water. The City of Algoma uses bedrock aquifers for their water supply needs. Surface water in the vicinity is not used as a drinking water source.

History of Contamination

Initial results of groundwater samples from site monitoring wells indicated the presence of low level organics (benzene and chloromethane), metals (chromium and mercury), and

landfill gas (methane). Elevated levels of indicator parameters were also measured (iron and manganese).

Initial Response

Upon closure in 1983, waste was estimated to be 32 feet deep and in contact with groundwater in some areas. Under approval of WDNR, the operators of the AMLF constructed a final cover on the LDA consisting of two feet of clay-like material. No leachate collection or gas collection systems were included. By 1990, at the time of the Remedial Investigation/Feasibility Study (RI/FS), the cover had been subject to freeze-thaw degradation and did not conform to NR 500 Wisconsin Administrative Code (WAC) standards.

Basis for Taking Action

Based on the findings of the RI/FS, it was concluded that the AMLF was contributing to the contamination of groundwater at the site. Concentrations of benzene, iron, manganese, cadmium, chromium, and mercury were either elevated above background or above WDNR enforcement standards (ES) or preventive action limit (PAL) standards.

Results of the RI included:

- No evidence of transport of hazardous substances from the landfill into the wetlands, swales, and valleys in the vicinity;
- Pesticides were found in low concentrations in soil/sediment at the site;
- Several inorganic contaminants were detected in soil/sediment including arsenic, beryllium, chromium, copper, magnesium, selenium, silver and zinc;
- Surface water sampling results indicted that there had not been any apparent release of hazardous substances from the site to any surface water body;
- There were no organic contaminants of concern or metals reported in concentrations significantly above background or blank concentrations in the private water supply wells near the site;
- LDA has a ½ to 1-foot layer of topsoil over a 1 to 1½-foot compacted silty clay cover. NDA and SDA do not have a cover over the waste;
- Localized releases of constituents of concern have occurred from the LDA to the groundwater, and
- Total cancer risk estimates were within the risk range of 1×10^{-4} and 1×10^{-6}, and the hazardous index estimates are below 1.

IV. Remedial Actions

Remedy Selection

The assessment of the site in the Record of Decision (ROD) signed on September 29, 1990, concluded that actual or threatened releases of hazardous substances from the site, if not addressed by implementing the response action selected in the ROD, may present a potential threat to public health, welfare, or the environment.
Based on the feasibility study, six remedial alternatives were defined. The alternative selected included addressing both contaminated soil and groundwater. The major components of the selected remedy included:

Table 2 Remedial Actions and Objectives of Actions

Remedial Action	Objective of Action
A minimum two foot compacted clay cover on the LDA and NDA with an overlying soil layer to prevent freeze-thaw degradation of the clay. Soil Cover over the SDA.	To eliminate direct contact and intercept direct precipitation and divert it from contact with underlying soils. The cap is constructed over the LDA and NDA according to NR 504.07 Wis. Adm. Code. A soil cover over the SDA unless further characterization of this area indicates alternative actions. EPA approved the *Remedial Action Implementation Report* documenting completion of this action on August 24, 1994. Operation and maintenance of the cap and cover are ongoing.
A groundwater monitoring program to measure changes in groundwater conditions throughout the site.	To monitor the quality of the groundwater in the unconsolidated sand and gravel aquifer. The system consists of 6 piezometers, 10 observation wells, and 4 private drinking water wells. Construction of the piezometers and observations was essentially completed by 1993 and the construction reports can be found in the December 2003 *Five-year Groundwater Assessment Report and O&M Report No. 15.* Since 1999, the monitoring wells are sampled annually, the private wells, every five years. Prior to 1999, the wells were sampled semi-annually, and prior to 1996, quarterly.
A landfill gas venting system with monitoring probes on the LDA and NDA	To eliminate the potential vapor phase contribution that the waste constituents may have on groundwater and to monitor the quality of the vapor phase constituents. The system consists of 7 gas monitoring probes and 7 gas vents on and near the LDA and NDA. The gas venting system was installed to reduce gas build-up beneath the cap and to reduce potential heaving and cracking of the cover. The landfill gas sampling plan is described in the 1995 Final O&M plan. Landfill gas monitoring is conducted annually since 1999 and was semi-annual between 1999 and 1994
Institutional controls consisting of: -Access restrictions -Deed restrictions -Fencing	To place sufficient deed and access restriction to assure that: • The integrity of the cap or soil cover is not comprised • No construction of drinking water wells occurs on site • No interference with the O&M of the treatment and monitoring systems.

	The security fence is a standard chain link fence topped with a barbed wire, with a couple of access gates at strategically placed locations. Approval for the fence construction was given in August 1994 and its construction is documented in the Remedial Action Implementation Report. Numerous deed and access restrictions have been filed with the Kewaunee County Register of Deeds.

Remedy Implementation

The PRP Group signed a consent decree subsequent to the ROD on August 29, 1991. The final remedial design/remedial action (RD/RA) workplan was submitted on November 5, 1992. US EPA approved the final remedial design plan on April 7, 1993. The remedy as described above was constructed between July and December 1993.

Minor changes in the scope of work (addition of monitoring wells and the testing of the clay cap material) caused some minor delays, but there were no major deviations from the ROD. An amended consent decree and amended scope of work was signed in July 1993.

System Operation/O&M

Consultants for the PRP Group are conducting long term monitoring and maintenance activities in accordance with the Final Operation and Maintenance Plan dated March 1993.

Table 3: Annual System Operations/O&M Costs

Year	Total costs rounded to nearest $1000
1997	$45,000
1998	$69,000
1999	$31,000
2000	$28,000
2001	$29,000
2002	$27,000
2003	$60,000

Current status of remedy has not changed significantly since the last five-year review. The landfill caps continue to minimize the infiltration of groundwater and the passive venting system continues to allow the controlled release of methane. The site security (fence) remains intact and the landfills are mowing regularly.

V. Progress since the Last Review

The State of Protectiveness as described in the five-year review dated March 29, 1999, was as follows:

The remedies at the Algoma Landfill remain protective of human health and the environment. The cap appears to be effective at containing contaminants through preventing infiltration of rainwater and snowmelt waters and preventing direct contact with contaminated soils. The gas monitoring and gas venting systems are operating as intended. Although there are exceedances, most contaminants remain confined to the Site and do not appear to be impacting private drinking water sources. Institutional controls at the landfill remain in place and are effective.

The Recommendations made in the five-year review and the subsequent actions taken are displayed in Table 3.

Table 4: Actions Taken Since the Last Five-Year Review

Issues from previous review	Recommendations/ Followup actions	Party Responsible	Action taken and Outcome	Date
Dense vegetation on cover. Need a good balance between evapotranspiration, cross drainage. Better inspections needed	Mow the covers more often	City of Algoma	The landfills are mowed twice yearly by the City of Algoma	Twice per year
Steep side slopes and sloughing	The slopes should be striped and fill should be placed to flatten the slope to prevent further sloughing and potential leakage into the landfill.	PRP Group	A final grade survey was performed in November 2000 confirmed that existing grades on the sideslopes are consistent with the as-built grades. All objectives for drainage established during the design and construction continue to be met as established with the November 2000 grades.	Nov 2000
Potential methane gas migration on the south slope of the LDA	Conduct barhole test probes	PRP Group	20 barholes installed in areas of stressed vegetation, and bare soil. Testing indicates gas migration is very localized. Lack of vegetation is due predominantly due to lack of soil	Sep 1999, Sep 2000, Nov 2000
Potential ponding in depressions on cover	The depressions in the landfill should be stripped of vegetation and backfilled to prevent local concentrations of infiltration of precipitation and snowmelt waters.	PRP Group	A final grade survey was performed in November 2000 confirmed that positive drainage continues to be maintained on the final cover and the interior and perimeter ditches/swales.	Nov 2000
Fence in need of maintenance and repair	The fence should be inspected for areas in need and repaired accordingly.	City of Algoma	During June 2001, the City of Algoma completed repairs to each portion of the fence that required maintenance.	June 2001
ARAR exceedances	The piezometer, OW-9, should be changed to an observation well. Resulting exceedances in groundwater contaminant levels show that upward trends bear particular attention including the LEL for methane.	PRP Group	There was no observation well constructed at the OW-9 location.	

The Consultant for the PRP group, RMT, Inc., in their annual O&M reports state that groundwater exceedances of iron and manganese are a result of geochemically reducing conditions associated with natural attenuation evident at many landfills.

VI. Five-Year Review Process

Notification and Start of the Review

On January 29, 2004, Annette Weissbach, WDNR Project Manager, notified the City of Algoma Administrator, Tom Romdenne, that WDNR would be completing the five-year review.

Identification of the Five-Year Review Team

Review team members are WDNR Project Manager Annette Weissbach and USEPA Region V Project Manager David Linnear.

Components and Schedule of the Five-Year Review

Components of the review are as follows:

- Document review
- Data Review
- Site Inspection, and
- five-year review Report development and review.

The schedule extends from January through March 2004.

PRP and Community Notification

On February 11, 2004, a Class I Notice was published in the Algoma Record Harold newspaper asking for public input and comment. No input or comments from the public were received.

Document and Data Review

Annette Weissbach, WDNR Project Manager, conducted the document and data review during February and March 2004. Review of the combined ***Five-Year Groundwater Assessment Report*** and ***Operation & Maintenance Report No. 15*** was also performed in order to complete the five-year review.

ROD Contaminants of Concern

Cadmium and Chromium

During nineteen post-cap monitoring rounds, there has been one detection of cadmium and two detections of chromium. Cadmium was detected in 1999 at 0.87 µg/L slightly above the NR 140 WAC PAL of 0.5 µg/L. Chromium was detected in 1999 at 3.8 µg/L, and in 2003 at 5.3 µg/L (both below the PAL of 10 µg/L).

Iron and Manganese

The highest iron (Fe) concentrations in the range of 10,000 to 14,000 µg/L (the Enforcement Standard [ES] for Fe is 300 µg/L) are consistently measured in OW-9, a piezometer less than 100 feet downgradient of the LDA. The highest manganese (Mn) concentrations in the range of 800 to 1000 µg/L (ES = 50 µg/L) are consistently measured in OW-21, a piezometer 700 feet downgradient of the LDA.

Review of the data indicates that elevated levels of Fe and Mn are present in a plume downgradient of the landfills (primarily associated with the LDA). Research conducted on numerous landfills states that the presence of elevated levels of these metals is a common indicator of natural attenuation at landfills (Weidemeier, et. al., 1995).

The attached Figure 5 is an east-west cross section of the site showing a conceptual site model of the relationship between dissolved oxygen, Fe, and Mn. In shallow groundwater immediately adjacent/sidegradient (water table well OW-10R) of the LDA, Fe and Mn are only slightly elevated. In Piezometer OW-9 about 100 feet downgradient of the LDA, extremely elevated levels of Fe are measured. Mn concentrations are about the same as in OW-10R.

At about 700 feet downgradient, less elevated levels of Fe are again measured (piezometer OW-21). Mn concentrations continue to be elevated in OW-21 and OW-20 (water table well). Upward gradients are measured in the OW-20/OW-21 well nest and it appears groundwater is discharging to a wetland. It is estimated that Fe and Mn will meet NR 140 WAC PALs in 10 to 20 years. The attached Figure 9 shows results of groundwater sampling for iron and manganese in private drinking water wells surrounding the site.

Mercury

Mercury has not been detected at any wells since 1998.

Benzene

Benzene has been detected consistently in one well (OW9). The concentration has decreased from 1 µg/L to less than 1 µg/L since 1992 and to a nondetectable level in 2003. The PAL for benzene is 0.5 µg/L.

Site Inspection

The WDNR PM and US EPA RPM conducted a site visit on March 24, 2004. The weather was partly cloudy and temperatures were in the mid 40s. Tom Romdenne, City of Algoma Administrator, and John Oswald, Project Manager, RMT (on behalf of the PRP Group), accompanied David Linnear, US EPA and Annette Weissbach, WDNR, during the site visit.

Patches of snow were present in shaded areas, but for the most part, all three landfill caps were free of snow and accessible for walking. The vegetative cover was thick, uninterrupted, and appeared in its seasonally expected form for early spring.

The fence was is in good repair. All gates were locked and signs were posted. The monitoring wells, gas vents, and gas probes were locked and appeared in adequate form. The adjacent gravel pit operations were active during the site visit. The exposed gravel pit wall is approximately 5 to 15 feet from gas monitoring probe GMP-7. The drop-off from the grade at GMP-7 to the pit floor is approximately 40 feet. It appears the maximum encroachment of pit operations to GMP-7 and the south face of the LDA has been reached, i.e., GMP-7 is located on adjoining property immediately next to the landfill and the gravel pit.

As part of the AMLF annual O&M activities, RMT consultants conduct a yearly site visit that was most recently performed on October 23, 2003. The inspection report noted "adequate" conditions for the final cover, groundwater wells/probes, gas vents, drainage facilities, fencing and signs, and access road.

Interviews

No site interviews were conducted, however, during the site visit, discussions were held with the City of Algoma Administrator, Tom Romdenne. We discussed the condition of the vegetated cover, surrounding land uses, property ownership, and possible future uses of nearby properties. We also discussed the operations of the adjacent sand and gravel pit.

VII. Technical Assessment

Question A: Is the remedy functioning as intended?

Yes.
Review of documents, ARARs, risk assumptions, the results of the site inspection, and the analysis of the groundwater monitoring indicates that the remedy is functioning as intended by the ROD. The capping of the landfills, the passive gas venting system, and the fencing of the sites appears to achieve the objectives of the remedial objectives, which required the minimization of migration of contaminants to groundwater and prevent direct contact with, or ingestion of, contaminants in waste materials.

The monitoring well network is adequate in measuring the status of the contaminant plume. A groundwater plume impacted by iron and manganese is apparent downgradient of the site, however, neither of these compounds is of public health concern. Furthermore, these compounds are found naturally occurring at various concentrations near the site and regionally.

New users of groundwater downgradient of the site have been identified, however, the drinking water wells are cased through the sand and gravel aquifer that is impacted near the site. During the site inspection, no activities were observed that would have violated the institutional controls.

Question B: are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of remedy still valid?

Yes.
There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy. The NR140 groundwater quality standards are the ARARs in effect for the site. In 1996, iron was removed from the groundwater monitoring parameter list in NR507.19 Wis. Adm. Code. Manganese is typically only part of the baseline monitoring program for landfills and is not a mandatory detection monitoring parameter.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No. There was no information generated during the second 5-year review process or other information that calls into question the protectiveness of the remedy.

Technical Assessment Summary

Upon completing review of the *Five-Year Groundwater Assessment Report*, the *Operation and Maintenance Report No. 15*, and the site inspection, the remedy appears to be functioning as intended by the ROD. There are some issues that will be described below, however, overall, long term protectiveness of the remedy remains as is.

VIII. Issues

Table 5: Issues

Issues	Affects current protectiveness (Y/N)	Affects future protectiveness (Y/N)
Methane detected in GMP-7 in 2002	No	No
Sand & gravel pit operations immediately adjacent to site	No	Maybe

IX. Recommendations for Follow-up Actions

Table 6: Recommendations and Follow-up Actions

Issue	Recommendations And Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date
Methane in GMP-7	Continued monitoring	PRP Group	USEPA WDNR	Annually
Pit operations	The PRP group and the owners of the adjoining gravel pit should discuss the requirement to maintain appropriate slope and distance from the landfill and the monitoring points. It is recommended that a written agreement be signed by both parties that describes these requirements.	PRP Group	WDNR	Summer 2005

X. Protectiveness Statement(s)

The assessment of this five-year review found that the remedy is functioning as designed. The remedy is protective of human health and the environment in the short term. All immediate threats at the site have been addressed through capping of the waste material, passive venting of landfill gases, and site fencing. Additional institutional controls consisting of access restrictions, deed restrictions and fencing are present.

Exceedances of iron and manganese public welfare standards for groundwater are anticipated to continue for 10 to 20 years. Long-term protectiveness of the remedial action will be verified by continuing routine groundwater samples to monitor migration of the contaminant plume downgradient of the landfill. Additional sampling and analysis will continue annually until ARARs are met. When groundwater cleanup standards are met, the long-term protectiveness of the remedy will be met.

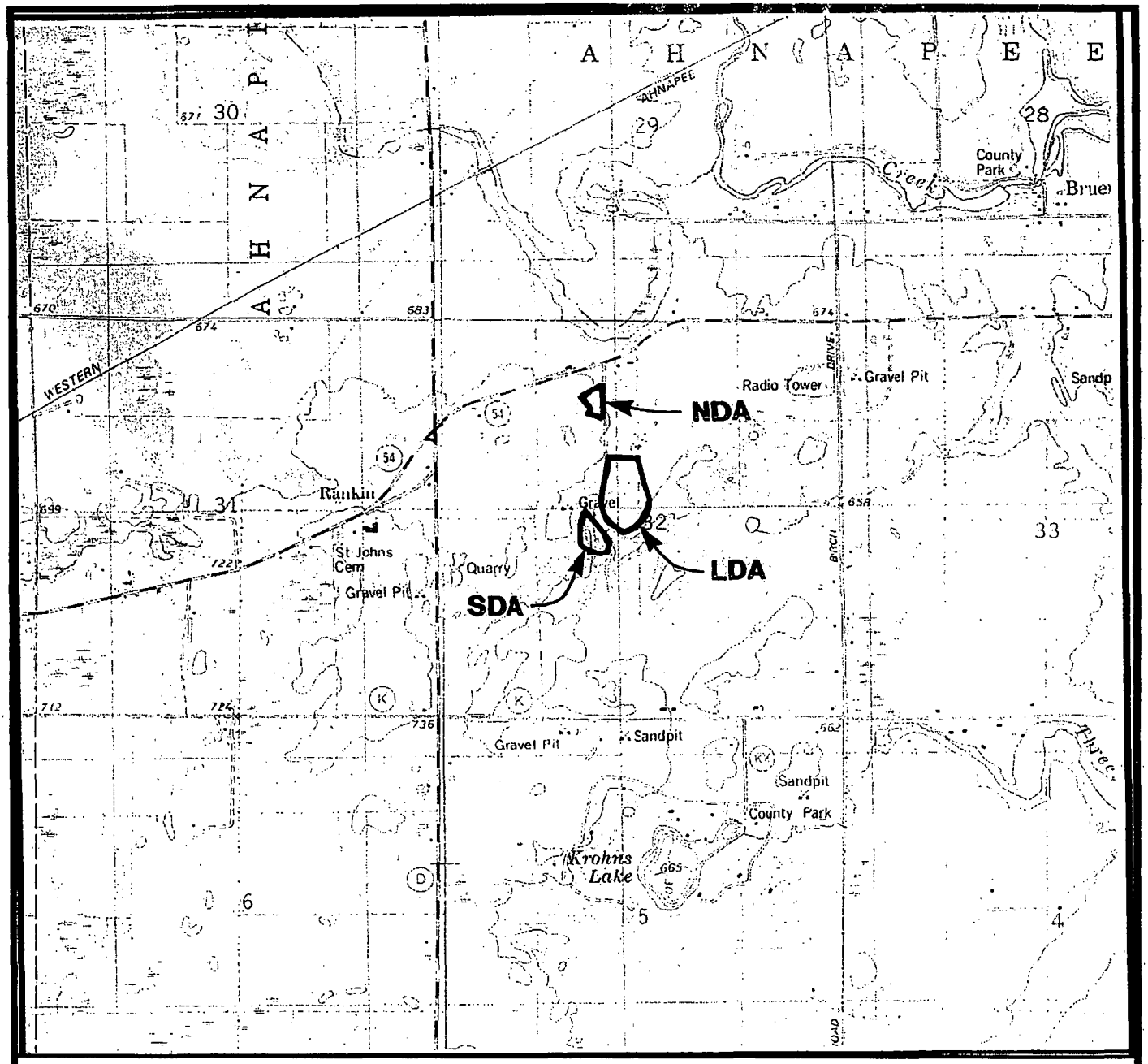
XI. Next Review

The next review for the Algoma Municipal Landfill is required by March 2009.

Attachments

(scanned from the combined ***Five-Year Groundwater Assessment Report and Operation & Maintenance Report No. 15)***

Figure 1	Site Map
Figure 5	Conceptual Site Model
Figure 9	Iron And Manganese Concentrations In Nearby Private Drinking Water Wells



STATE LOCATION

NDA=NORTH DISPOSAL AREA
LDA=LANDFILL DISPOSAL AREA
SDA=SOUTH DISPOSAL AREA

SOURCE: BASE MAP FROM ALGOMA, WI. AND CASCO, WI. 7.5 MIN. USGS QUADRANGLE.
LOCATION: NW1/4,SE1/4, SW1/4, SEC 32, T25N, R25E

N

0 2000 4000

SCALE: 1"=2000'

RMT

ALGOMA MUNICIPAL LANDFILL
5 YEAR GROUNDWATER ASSESSMENT (1999-2003)
ALGOMA, WISCONSIN

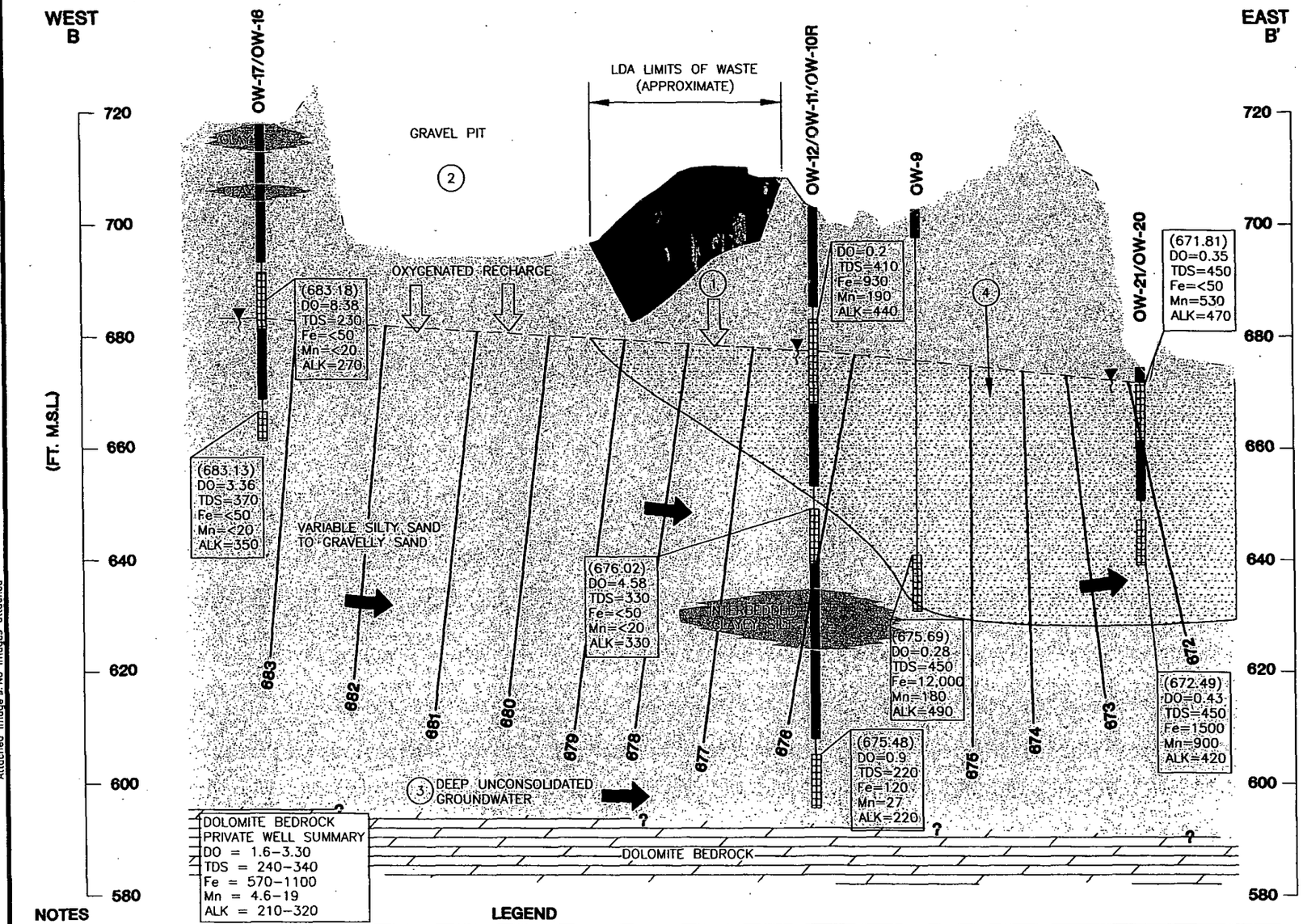
SITE LOCATION MAP

DRAWN BY:	DEFOEJ
APPROVED BY:	JCO
PROJECT NO.	22478.10
FILE NO.	224781008.DWG
DATE:	DECEMBER 2003

FIGURE 1

$$SCALE$$
$$ROT$$
$$SYTIME$$
Attached Xref's: x

$$DWG$$
$$USER$$
$$PRF$$
$$PTABLE$$
$$PLOTTER$$



CONCEPTUAL MODEL OF IRON AND MANGANESE GROUNDWATER IMPACTS

1. ORGANIC MATERIALS IN THE LDA NATURALLY DEGRADE RESULTING IN DEPLETED OXYGEN LEVELS IN GROUNDWATER.
2. OXYGEN-RICH RECHARGE WATER ENTERS THE SHALLOW UNCONSOLIDATED AQUIFER. DISSOLVED OXYGEN DECREASES WITH DEPTH.
3. DEEP UNCONSOLIDATED AQUIFER GROUNDWATER HAS DEPRESSED OXYGEN LEVELS DUE TO NATURAL MINERAL OXIDATION AND LONG RESIDENCE TIMES. Fe AND Mn CONCENTRATIONS IN OW-12 ARE ABOVE DETECTION, WHILE TDS AND ALKALINITY ARE SIMILAR TO OTHER UN-IMPACTED WELLS.
4. GEOCHEMICAL SHADOW IN GROUNDWATER WITH REDUCED OXYGEN RELEASES NATURALLY OCCURING Fe AND Mn WITHIN THE AQUIFER. THIS INCREASES DISSOLVED Fe AND Mn CONCENTRATIONS. ALKALINITY ALSO INCREASES DUE TO THE LOWERED pH THAT RESULTS FROM THE DEGRADATION OF ORGANIC MATTER IN THE LANDFILL.

HORIZONTAL SCALE: 1"=300'
VERTICAL SCALE: 1"=20'
VERTICAL EXAGGERATION=15X

NOTES

1. LIMITS OF WASTE ARE APPROXIMATE AND WERE PRESENTED IN THE REMEDIAL ACTION IMPLEMENTATION REPORT (RMT, 1994)
2. GROUNDWATER ELEVATION DATA WAS COLLECTED ON SEPTEMBER 15, 2003 DURING THE SEPTEMBER 2003 MONITORING EVENT. ELEVATIONS ARE REPORTED AS FEET, M.S.L.
3. ANALYTICAL RESULTS FROM THE SEPTEMBER 2003 MONITORING EVENT. DISSOLVED OXYGEN (DO), TOTAL DISSOLVED SOLIDS (TDS), AND ALKALINITY (ALK) ARE IN mg/L. IRON (Fe) AND MANGANESE (Mn) ARE IN ug/L.

LEGEND

- EXISTING GROUND SURFACE
- STRATIGRAPHIC BOUNDARY, DASHED WHERE INFERRED
- WATER TABLE ELEVATION
- 678 — POTENTIOMETRIC CONTOUR
- GROUNDWATER FLOW DIRECTION
- (675.48) GROUNDWATER ELEVATION (FT. M.S.L.)
- WASTE
- CLAY SILT
- SILTY SAND TO GRAVELLY SAND
- DOLOMITE BEDROCK
- GEOCHEMICALLY REDUCED GROUNDWATER

WELL CONSTRUCTION
- WELL SEAL
- SAND PACK
- SCREENED INTERVAL

PROJECT: **ALGOMA MUNICIPAL LANDFILL**
FIVE YEAR GROUNDWATER ASSESSMENT (1999-2003)
ALGOMA, WISCONSIN

SHEET TITLE: **CROSS SECTION B-B'**

DRAWN BY: DEFOEJ	SCALE:	PROJ. NO. 22478.10
CHECKED BY: PT	AS SHOWN	FILE NO. 224781004.DWG
APPROVED BY: JMB	DATE PRINTED:	**FIGURE 5**
DATE: DECEMBER 2003		

RMT, INC.
744 Heartland Trail
Madison, WI 53717-1934
P.O. Box 8923 53708-8923
Phone: 608-831-4444
Fax: 608-831-3334

PLOT DATA
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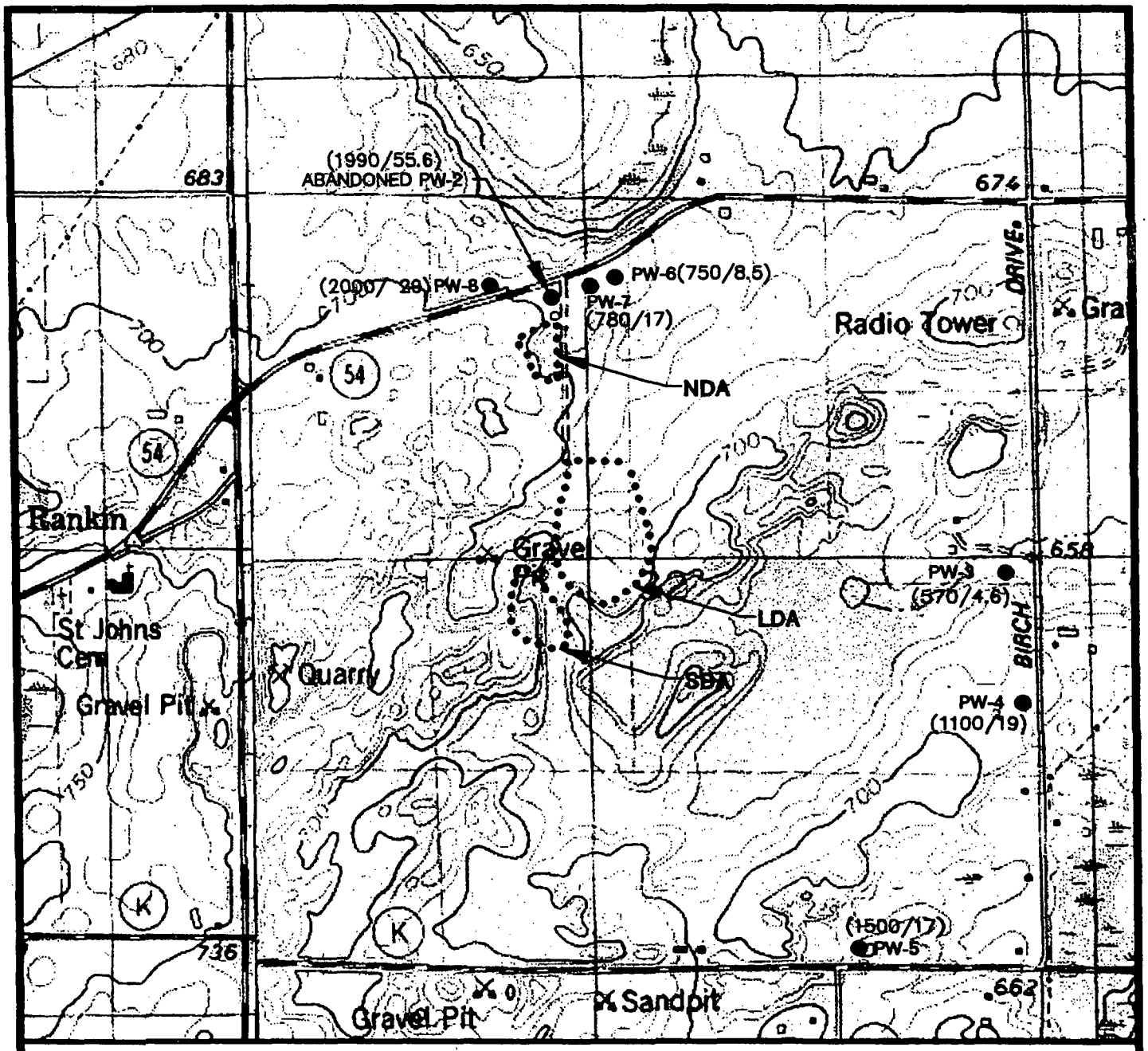
Attached Image s: No images attached



STATE LOCATION

LEGEND

PW-8 ● (2000/ 29) WELL I.D. (IRON CONCENTRATION/ MANGANESE CONCENTRATION, UG/L)

CONCENTRATIONS SHOWN ON THIS FIGURE ARE FROM THE MOST RECENT SAMPLING EVENT AT EACH RESPECTIVE WELL. SEE APPENDIX E FOR COLLECTION DATES.

N

SOURCE: BASE MAP FROM ALGOMA, WI. AND CASCO, WI. 7.5 MIN. USGS QUADRANGLE.

LOCATION: NW1/4,SE1/4, SW1/4, SEC 32, T25N, R25E

0 1000 2000

SCALE: 1"=1000'

RMT.

ALGOMA MUNICIPAL LANDFILL
5 YEAR GROUNDWATER ASSESSMENT (1999-2003)
ALGOMA, WISCONSIN

PRIVATE WELL IRON AND MANGANESE CONCENTRATIONS

DRAWN BY:	MEYERHOC
APPROVED BY:	JCO
PROJECT NO.	22478.10
FILE NO.	224781006.DWG
DATE:	DECEMBER 2003

FIGURE 9

PLOT DATA
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